ON THE ANALOGY OF RINGWORM, AND OF SOME OTHER SKIN DISEASES, TO FAIRY RINGS.

By ROBERT E. BROWN, M. D., EDINBURGH.

(*From the Edin. Med. and Surg. Journal, No.* 172.)

It is well known that several of the diseases affecting the skin of man and of some of the lower animals invariably assume a form more or less circular. This is particularly noticeable in *tinea capitis*, and in some varieties of lepra; and the term ringworm, by which the first of these diseases is popularly known, is derived, in part, from this circumstance. I am not aware that any attempt has been made to explain this matter, or that it has been regarded in any other way than as an ultimate fact. The cause of it is not only a matter of some interest, but it might possibly be of some practical importance in the treatment of these affections; and I propose in the following communication to attempt to indicate an explanation of it, by endeavouring to draw an analogy between these diseases, and those appearances termed fairy rings, the cause of which appears to be well made out. It may, perhaps, seem to some as if this was a subject on which little required to be said. It may be thought that the circular form of these skin affections depends simply upon the fact, that the disease originates in a point and has a tendency to spread; and that it follows almost as a matter of course, or of the utmost probability, that it will extend in a circular direction. There may be some plausibility in this: but still, Whence is this tendency to spread? and what is the nature and history of that process? These are the questions on which it is more particularly the object of this communication to endeavour to throw light.

Upon meadows and old pasture grounds, there not unfrequently occur rings of dark-green and luxuriant grass, which are well known by the name of fairy rings. They are most abundant, and are best known in this country, in the southern parts of England, where fields and meadows are in many districts thickly marked by them. They are met with of all sizes, from a few inches, to six, eight, or even twelve feet in diameter; and the majority of them form remarkably perfect circles, or segments of circles. A fairy ring, when watched from time to time, presents several notable points for observation. During the greater part of the year, the circle of rich green grass itself is the chief thing that can be observed; but at certain seasons there may be noticed, immediately exterior to it, another ring, composed of mushrooms or some other sort of fungous plants; and beyond these again, a third ring of brown and withered grass. The fungi met in connection with the fairy rings are the common mushroom (*Agaricus campestris*), which is found connected with rings of the largest size. The Champignon mushroom (*Agaricus orcades*, Withering) is of more common occurrence, but the rings connected with it are smaller in size, though more perfectly circular. Besides these, there are three other fungi, which more rarely present themselves, the *Agaricus terreus; Agaricus Procerus*, and *Lycoperdon bovista*. The fairy rings continue visible for several years, during which time they are in a constant state of increase, varying in different instances from a few inches to two feet annually. In the course of this growth two or more not unfrequently come in contact; and when this takes place, even though the fungi of the several rings are different, they do not continue themselves into each other; but coalescing, they form one large and irregular figure.

These observations were made, and were connected together into a theory of the origin of these curious appearances, by Dr Wollaston, in an essay which is published in the Philosophical Transactions for the year 1807, and which displays in a high degree the ingenuity and perfection so uniformly characteristic of the observations and inventions of that philosopher. The explanation given by Dr Wollaston is very satisfactory in itself; and, being in some measure supported by recent researches, it seems to me that little doubt can be entertained of its accuracy.

According to Dr Wollaston, the rings originate in the following manner. A group of fungi spring up upon a spot of ground and flourish there until the soil becomes exhausted of some peculiar pabulum necessary for their existence. The spawn which they throw off, and which falls upon the ground already exhausted, finds no stimulus to growth, and it rots or lies dormant; but that which falls beyond this spot of ground upon the unexhausted soil, produces a new crop of the plants exterior to the circumference of the original group. These in their turn flourish for a while, throw off spawn, die, and are succeeded by a fresh ring of fungi growing round the outer border of the last. When the fungi die and rot, they act as manure to the soil, and stimulate the grass to a strong and luxuriant growth. With regard to the production of the outermost ring, consisting of withered grass, Dr Wollaston supposes that the fungi, in their vital desire for nourishment, withdraw it not only from the ground upon which they immediately grow, but also from the soil extending to a short distance beyond ; and in consequence of this, the grass which grows there is enfeebled in its strength, and at last withers.

In this manner we can understand how the several rings are formed; how they follow each other in the order we have mentioned, and how they enlarge in their dimensions. The recent researches of Dr J. Schlossberger, and of Mr J. T. Way, into the chemical composition of the mushrooms, and of the other fungi connected with fairy rings, give considerable countenance to the theory of Dr Wollaston. They show that these plants abound above most, if not all others, in nitrogen, in phosphates, and in the other matters, the presence of which makes a soil rich and fruitful. In consequence of this, they exhaust the soil upon which they grow with great rapidity and effect, and again renovate its powers in like manner when they are applied to it as manure.

Notwithstanding the beauty and simplicity of Dr Wollaston's theory, there are some points in it which, on consideration, may seem to be assailable ; and which, if they had been pointed out at the time of its publication, might possibly have laid it open to serious objections. It may appear in the first place, that there is no sufficient reason why the grass is not equally luxuriant before the fungi have preceded it, as it becomes afterwards. All the most valuable substances which compose these plants, or at least the chief part of them, existed in the soil before the fungi sprung up, and when they return to the soil again in the form of decayed vegetable matter, the soil is no richer than it was at first. Why, therefore, it may be asked, should the grass grow more richly and strongly upon it then, than it did before ? Again, why should the fungi form a ring or grow so well at the borders of the circle, and be incapable of growth in its interior, as Dr Wollaston's experiments indicated ? After the fungi had extracted all the available food from the soil, and before their decay was so complete as to admit of the substances of which they were composed becoming again available for the purposes of vegetation, it is obvious that a stop would be put to the growth of fresh plants. But when once the decay was complete, and the plants having returned to the state of earth, had been restored to the soil from which they had sprung, it is not so apparent why their further growth should then be arrested.

In answer to these objections, it is to be held in mind that the valuable constituents of the soil, the phosphates, sulphates, and other salts of the alkalis, the alkaline earths, and the several other substances necessary to vegetable growth, may occur in forms available to some sorts of plants and not so to others. It is conceivable, and it is not improbable, that the vital force of the mushroom may differ so much in its degree of activity, and in its mode of action, from the vital force of the grass, that the chemical or mechanical forces which preserve the substances proper for the nutrition of these plants in a state unfit for that purpose, may be resolved or overcome by the one plant and not by the other. But, whatever the explanation may be, it appears to be a fact, that one plant may thrive in a certain soil, and that another may not do so, although substances suitable for the nutrition of both may be present in it. As a farther reason for the mushrooms not growing again upon the same ground, it may be stated, that in the process of decay these plants evolve a considerable quantity of nitrogen in the form of ammonia; and that, in proportion as they do this, the soil must become in the same degree unfitted for their further production; as nitrogen, or ammonia, is one of the substances most necessary for the nourishment of these plants.

It may further seem as if there was no sufficient reason why that which Dr Wollaston conceives to take place with regard to the mushroom should not also take place in the case of nearly all other plants. If mushrooms are forced to extend outwards in a circular direction, when they have exhausted the soil underneath their original seat, why, it may be asked, are not other plants forced to do so likewise? The reason of this may possibly depend upon the difference in the roots of the two plants. Other plants send out their roots in a circular or globular direction, and so collect food for themselves from an extensive space of soil. But the fungi being unable to do this, both from the nature of their roots, and because they spring up so quickly, are forced themselves to move outward, and seek nourishment in new soil.

Some botanists, I believe, do not accept of Dr Wollaston's theory, but ascribe the origin of the fairy rings to a mushroom spore or stem, increasing and extending itself in a circular direction. They say that the stem of the central and primary mushroom extends itself by its concentric growth from the centre of the fairy rings to their circumference, and there throws up its fructification. I am scarcely competent, from my limited knowledge of botany, to discuss the merits of this view. It does strike me, however, as a somewhat startling statement, and one the truth of which would require to be well ascertained, (which, so far as I can learn, it is not,) before founding much upon it,—that the stem of a mushroom extends itself underground till it attains the diameter of ten or twelve feet, an extent to which the fairy rings not unfrequently reach.

Having thus given a sketch of Dr Wollaston's account of the nature and formation of the fairy rings, I shall now consider those skin diseases which I conceive to bear some analogy to these formations. There has been some interest excited of late years by a discovery, made in the first instance, I believe, by Professor Owen, that vegetable growths occur in some of the diseased structures of the higher animals. Professor Owen observed these in the case of tubercles from the lungs of the flamingo; and the observations of M. Schönlein of Berlin, and of many other persons, both in this country and on the continent, since the announcement of that discovery, have shewn that vegetable growths are of constant occurrence in some diseases, and that in the case of several skin affections they appear, if not to constitute the diseases themselves, to be at least the exciting cause of them. The disease termed *tinea favosa* was the first in which these vegetations were observed to occur in man. This observation was made by M. Schönlein in the year 1839, and since that time it has been fully examined and verified by M. Gruby of Vienna, and other observers; and the same thing has been noticed in several other skin diseases. As the *tinea favosa*, however, has been made, more than any other, the subject of examination with regard to this matter, and as it is one of the most perfectly circular of the skin diseases, I shall select it in particular for the purpose I have at present in view. It is, however, to be held in mind, that what is said with regard to this disease may be applied with like force probably to all other circular skin diseases of vegetable origin.

The *tinea favosa* commences with an increased vascularity of the skin, on and about the place where the disease is subsequently to appear; and, at the same time, some desquamation of the cuticle takes place. After this has gone on for a few days, one or more spots, of a yellow colour, appear upon the space so affected, which gradually enlarge in their dimensions, and, if they meet with no obstacle, attain to the size of a sixpence or a shilling. They are stated to be "composed of capsules of epidermic scales, lined by a finely granular mass," which is especially abundant at the circumference. The term capsule, however, appears to me to convey a somewhat incorrect idea in the description of these bodies, and one which might lead to obscurity in the following remarks, inasmuch as it indicates a continuous and defined coat or covering of the granular mass. The true account of the matter is, that the granular mass is situated between two layers of the cuticle;—the strata of which are split up in the process of desquamation with which the disease commenced. The yellow matter consists of innumerable mycodermatous plants; as well as of a substance existing in greatest abundance at the periphery of the circles, which appears to be the soil from which they spring, and on which they flourish. The plants are very low in the scale of organized bodies, consisting simply of long, regularly-jointed, cylindrical filaments, terminating at their extremities in round or oval globules, which are probably the sporules of the plant. On examining a circular patch of the disease microscopically, the plants may be observed as filamentous lines, springing from the outer parts of the circle, and radiating inward towards the centre, where they generally terminate in a row of the sporules to which we have above alluded. About the centre itself, there may be observed a great accumulation of these beads or sporules, mingled with epidermic scales, and agglutinated together by exudations from the plants and the animal tissues.*

Having in the foregoing pages described the facts relating to the fairy rings, and to the *tinea favosa*, which are necessary for my present purpose, I shall now endeavour to point out the analogy which I conceive to exist between them. The growth of the mycodermata begins in the first instance, as I have already stated, at a point. The soil, or other source of nourishment connected with this point, cannot be expected to last very long; especially when it is taken into account how comparatively great a quantity of highly organized sporules and secretions the plants throw off, and which constitute some portion of the scurf and scales that perpetually separate themselves from the affected part. When the soil, therefore, at the point upon which the plants first spring is exhausted, they seek for nourishment on the parts exterior and contiguous to it. This, in its turn, is gradually exhausted of the required pabulum, and a further extension takes place; and so the circumference of the circle gradually and constantly progresses outwards, in the same way as the fairy rings. Exterior to the circle of plants, the skin is slightly reddened and inflamed, presenting the appearance of an outer ring. This may possibly arise from a cause similar to that which Dr Wollaston thinks gives rise to the outer circle of withered grass which is seen in the fairy rings:—to wit, the abstraction of nourishment by the plants from the parts beyond where they actually grow. The effects upon the skin of such an abstraction of nourishment would doubtless be to excite some degree of inflammation in it, by stimulating it to increased action; and this would manifest itself by a reddened appearance.

When two or more circles of tinea meet, they do not cross or continue themselves into each other; but, coalescing, they form, in the first instance, a sort of honey-combed appearance; and, by and by, the reticulations having disappeared, there remains one large and undivided figure. To this peculiarity the fairy rings present an exact parallel, as has already been noticed in the general description of these formations.

---

* For much of my information respecting the vegetations and microscopical appearances of *tinea favosa*, I am indebted to a Memoir on these subjects by Dr J. H. Bennett, published in the Transactions of the Royal Society of Edinburgh, Vol. xv.

The circles of ringworm may, at first sight, appear to differ very materially from the fairy rings, in the circumstance, that whilst the latter merely form rings, the appearances in the former extend throughout the whole circular space. This, however, probably appears to affect the integrity of the analogy, I am at present endeavouring to draw, to a greater extent at first sight, than it really proves to do after consideration. The cause of difference will be found to lie chiefly in the diversity between the two sorts of plants—of the mushrooms in the fairy rings, and of the mycodermata in the ringworms. Every one is familiar with the appearance of a mushroom; and I need scarcely recal to mind, that it springs perpendicularly from the soil, and consists of a stalk surmounted by an expanded head. It is very different, however, with the mycodermata of tinea. These consist, as has already been stated, of jointed, slender filaments, whose chief direction of growth is lengthwise, and whose breadth bears a very small proportion to their length. They, therefore, resemble creeping plants in some respects much more nearly than mushrooms, or any of the other fungi which are connected with the fairy rings. If some creeping plant be conceived to take the place of the mushrooms in the fairy rings, and to be capable of producing analogous formations, an appearance would be presented very unlike that of the fairy rings, and one which, in all probability, would be more comparable to the *tinea favosa*, so far as regards the point I am at present considering; for the long branches of the plants, as they proceeded from the centre, would be left behind; and the general mass would have the appearance of a circle, filled throughout its whole space with branches, radiating from the circumference towards the centre, after the manner somewhat of the spokes of a wheel, and very similar to what has been described as seen in the *tinea favosa*. Yet, though the whole appearance of such a growth would be most unlike to a fairy ring, the essential features of both would be identical, and the two would be strictly analogous. So is it in the case of ringworm. The mycodermata spring from the circumference of the circle, and, radiating inwards, fill up the interior space—obstructing the growth of the hair, (though the hair is not to be regarded as analogous to the grass in fairy rings,) and affecting the health of the skin.

I had intended, before concluding this communication, to advert to a chemical analysis of the scales of *tinea favosa*, made by M. Thenard, which is given in a short history and general account of the vegetable growths occurring on animals, by Mr Busk, published in the Microscopical Journal for 1841. It appeared to me not improbable, that the chemical composition of the mycodermata, and of their products, might bear some relation to that of the hair; which, by throwing light upon their origin and nature, might indicate some principles of treatment. On consideration, however, it seemed to me, that a chemical analysis of the crusts could scarcely guide us to any conclusion; for these consist of epidermis and other matters, in greater quantity than of mycodermata; and no knowledge, therefore, as to the composition of the mycodermata, could be derived from a knowledge of the composition of the scales.

EDINBURGH: PRINTED BY STARK AND COMPANY,
OLD ASSEMBLY CLOSE.